

Notice of Allowability

Application No.

10/817,264

Examiner

Kevin Verbrugge

Applicant(s)

LUBBERS ET AL.

Art Unit

2189

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the after-final amendment submitted 2/20/07.
2. ☒ The allowed claim(s) is/are 1-4, 8, 9, 13, 14, 16-21, 25 and 27-34.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of _____.
- Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____. |

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mitchell K. McCarthy, Registration No. 38,794, on 2/28/07. The Examiner called Mr. McCarthy to suggest the amendments to overcome the rejections of record and move the case to allowance. The amendments to claims 1 and 16 made in the after final amendment did not overcome the rejection of record and the Examiner suggested removing them since they were unnecessary. Therefore, claims 1 and 16 appear below in the form they had before that amendment was entered. Claim 21 is additionally amended to obviate a 35 USC 101 rejection.

The claims have been amended as follows:

1. (Currently amended) A method of storing data in a grid-based data storage system comprising:

defining an array of equal capacity data storage units, each data storage unit defined as a grouped plurality of data storage blocks from separate storage domains fewer than a total available number of storage domains; and

allocating each of the data storage units for storing either user data entirely or fault tolerance data entirely.

2. (Previously presented) The method of claim 1 further comprising aligning a base address of each data storage unit allocated for storing user data with an address defined by a multiple of a size of the storage blocks.

3. (Previously presented) The method of claim 1 further comprising defining a pointer that identifies a selected data storage unit.

4. (Previously presented) The method of claim 1 wherein the fault tolerance data is characterized as either mirror data or parity data.

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Previously presented) The method of claim 1 further comprising defining a sparing table that designates at least one data block in each row of said array as a spare data block.

9. (Previously presented) The method of claim 8 further comprising defining said sparing table to contain a plurality of sparing versions that each specify a different storage domain as containing said at least one spare data block in each row.

10. (Canceled)

11. (Canceled)

12. (Canceled)

13. (Previously presented) The method of claim 1 further comprising creating a metadata entry that identifies each data storage unit and the respective array of a plurality of arrays in which each data storage unit exists.

14. (Previously presented) The method of claim 13 wherein said metadata entry further comprises an entry indicating a storage format of each data storage unit.

15. (Canceled)

16. (Currently amended) A grid-based data storage system comprising an array of equal capacity data storage units, each data storage unit defined as a grouped

plurality of data storage blocks from separate storage domains fewer than a total available number of storage domains, wherein each data storage unit is individually allocated for storing either user data entirely or fault tolerance data entirely.

17. (Previously presented) The data storage system of claim 16 further comprising a plurality of spare storage blocks that are allocatable for storing data in the respective data storage units.

18. (Currently amended) A method of storing data in a grid-based data storage system comprising:

defining an array of equal capacity data storage units, each data storage unit

defined as a grouped plurality of data storage blocks from separate storage domains fewer than a total available number of storage domains;

allocating each of the data storage units for storing either user data entirely or

fault tolerance data entirely in accordance with a selected first storage format;

and

reallocating the data storage units for storing either user data entirely or fault

tolerance data entirely in accordance with a selected second storage format if

the number of data storage units in the first storage format is less than or

equal to the number of data storage units in the second storage format.

19. (Previously presented) The method of claim 18 further comprising:

defining a second array of equal capacity data storage units, each data storage unit defined as a grouped plurality of data storage blocks from separate storage domains; and
allocating additional data storage units in the second array if the number of data storage units in the first storage format is greater than the number of data storage units in the second storage format.

20. (Previously presented) The method of claim 18 comprising:
determining the data storage format of said array;
identifying an inaccessible storage domain;
accessing a sparing table that specifies at least one spare data block in each row of said array;
accessing metadata corresponding to said data storage format that specifies the location and content of each data block in said array; and
regenerating or copying data corresponding to each non-accessible data storage block to the respective spare data block.

21. (Currently amended) A data structure stored on a storage medium having an array of equal capacity data storage units, each data storage unit defined as a grouped plurality of data storage blocks from separate storage domains fewer than a total available number of storage domains, the data structure comprising a pointer that when multiplied by a storage capacity of said data storage blocks and by the number of rows

of data storage units allocated for storing user data, and to which an offset, if any, is added, produces a base address in each storage domain.

22. (Canceled)

23. (Canceled)

24. (Canceled)

25. (Currently amended) A method of accessing data in a data storage system comprising:

defining an array of equal capacity data storage units, each data storage unit

defined as a grouped plurality of data storage blocks from separate storage

domains fewer than a total available number of storage domains;

determining a domain and a physical address for at least one data storage block

by applying an array pointer value to determine a base address of said array,

applying a data storage unit pointer value to determine at least one domain to

be accessed and to determine a row such that the row number minus one is

multiplied by a capacity of said storage blocks and added to a base address

to produce a physical address; and

issuing an access command to said at least one domain that includes said

physical address.

26. (Canceled)

27. (Previously presented) The data storage system of claim 16 wherein the data storage blocks are of equal capacity.

28. (Previously presented) The data storage system of claim 16 wherein within a particular row, a data storage block in a first domain has the same logical address as a data storage block in a second domain.

29. (Previously presented) The data storage system of claim 16 wherein the array is adapted for storing data in the data storage blocks in a selected storage format by predetermined arrangements of user data, mirror data, and parity data associated with each of a plurality of selectable storage formats.

30. (Previously presented) The data storage system of claim 29 wherein the predetermined arrangement defines at least one row in the array that contains no mirror or parity data in the data storage blocks.

31. (Previously presented) The data storage system of claim 30 wherein the array is adapted for storing data in a RAID 5 or RAID 6 storage format.

32. (Previously presented) The data storage system of claim 16 further comprising metadata defining a pointer for identifying a selected data storage unit.

33. (Previously presented) The data storage system of claim 16 wherein a base address of each data storage unit allocated for storing user data is aligned with an address defined by a multiple of a size of the storage blocks.

34. (Previously presented) The data storage system of claim 16 wherein the fault tolerance data comprises either mirror data or parity data.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance:

None of the prior art of record discloses a grid-based data storage system as claimed in claims 1, 16, and 18. The amendments make it clear that the data storage units occupy fewer than all of the available storage domains. This new limitation, in combination with the preambles of these claims, defines a predefined grid structure mentioned in the specification and shown in Figs. 5-10, for example. This grid structures the array in such a way that the equal capacity data storage units are aligned in fixed positions across subsequent rows of the array.

The closest prior art of record is newly located U.S. Patent 6,311,251 to Merritt et al. in which data storage units are spread across separate storage domains fewer than a total available number of storage domains but not in a grid-based fashion. The data

storage units in Merritt et al. are spread across different groups of storage domains in a scattered, overlapping fashion. Furthermore, Merritt's data storage units are not restricted to storing either user data entirely or fault tolerance data entirely.

Claims 21 and 25 contain additional limitations not found in Merritt et al. or any of the other prior art of record.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

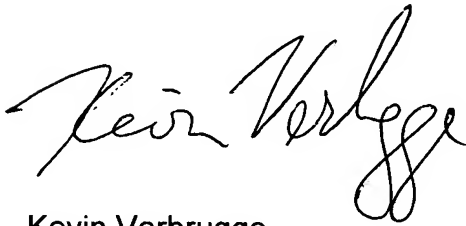
Any inquiry concerning this Office action should be directed to the Examiner by phone at (571) 272-4214.

Any response to this Office action should be labeled appropriately (including serial number, Art Unit 2189, and type of response) and mailed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, hand-carried or delivered to the Customer Service Window at the Randolph Building, 401 Dulany Street, Alexandria, VA 22313, or faxed to (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

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For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197.

A handwritten signature in black ink, appearing to read "Kevin Verbrugge". The signature is fluid and cursive, with the first name "Kevin" written in a larger, more prominent script than the last name "Verbrugge".

Kevin Verbrugge
Primary Examiner
Art Unit 2189